
Chapter 1

Amount and Distribution of Research Space

Highlights . . .

- ◆ In 1996, the science and engineering (S&E) fields occupied 285 million net assignable square feet (NASF) in the nation's research-performing colleges and universities. Forty-eight percent, or 136 million NASF, was devoted to research.
- ◆ The top 100 universities in research and development (R&D) expenditures accounted for 72 percent of all S&E research space in 1996, and 80 percent of all R&D dollars in 1994 (the most recent year for which data were available).
- ◆ From 1988 to 1996, the amount of S&E research space increased from 112 million to 136 million NASF, an annual increase of 2.4%.
- ◆ In 1996, 90 percent of all research-performing institutions had S&E research space in the biological sciences outside of medical schools, and 88 percent had S&E research space in the physical sciences. Only 20 percent of all institutions had S&E research space in agriculture.

Background

How much space do scientists and engineers have in which to conduct research? This chapter compares the amount of S&E research space available in different types of colleges and universities and in different S&E fields. In addition, changes in the amount of S&E research space available since 1988 are examined.

The Survey Questions

Information reported in Items 1a and 1b of the survey (see Appendix C) is contained in this chapter.

Item 1a collects data on space for each of the S&E fields in units of net assignable square feet (NASF). NASF was defined as the sum of all areas (in square feet) on all floors assignable to, or available to be assigned to, an occupant for specific use, such as instruction or research. Two categories of research space included:

- ◆ **Instructional and Research NASE** This includes all space used for academic purposes; it includes space that is used for instruction and space that is used for research.
- ◆ **Research NASE** This is space that is used only for research; it does not include space that is used for instruction.

Item 1a also asks for the total instruction and research space for all non-science fields. Hence, the combined instruction and research space for both the S&E fields and non-science fields results in an estimate of total academic space. For S&E fields only, Item 1b requests the amount of research NASF that is leased.

Data Considerations

Respondents are asked to consider several issues in determining the amount of space their college or university devotes to S&E research:

- ◆ **Space may be used for more than one purpose or be shared by more than one field** Examples include a laboratory that is used for research only part of the time or a building that is shared by two or more fields. For multi-purpose or shared space, the survey asks respondents to prorate the space. For instance, if a laboratory is used for research 30 percent of the time, respondents should

count 30 percent of the laboratory's NASF as research space. If mathematics and computer sciences use the same laboratory, the space reported for each field should reflect the amount prorated by the amount of time that field uses the space.

- ◆ ***Some fields require more research space than others.*** Agricultural research requires considerably more space than mathematics research. Thus, a larger amount of research space in a field does not necessarily mean that that space is sufficient for conducting research.
- ◆ ***Beginning this year (1996), respondents may include non-fixed equipment costing \$1 million or more.*** This does not appear to have affected the results, suggesting that respondents included this equipment in past surveys.
- ◆ ***Some space reported as under construction may be included in current space estimates.*** Research space under construction during the 1994 or 1995 fiscal years (see Item 4a) might be included in estimates of existing research space if that space was completed and occupied before the fall of 1995, the time the survey was administered.

Findings

How Much Space Was Available for S&E?

In 1996, the nation's 560 research-performing academic institutions had a total of 511 million NASF of academic space in all fields (Table 1-1). S&E fields occupied 56 percent of that space (285 million NASF).

The top 100 institutions in research expenditures contained as much academic space as all other types of research-performing colleges and universities combined. Although the top 100 institutions made up 18 percent of the 560 research-performing colleges and universities, they accounted for 50 percent of the space in all academic fields (255 million NASF).

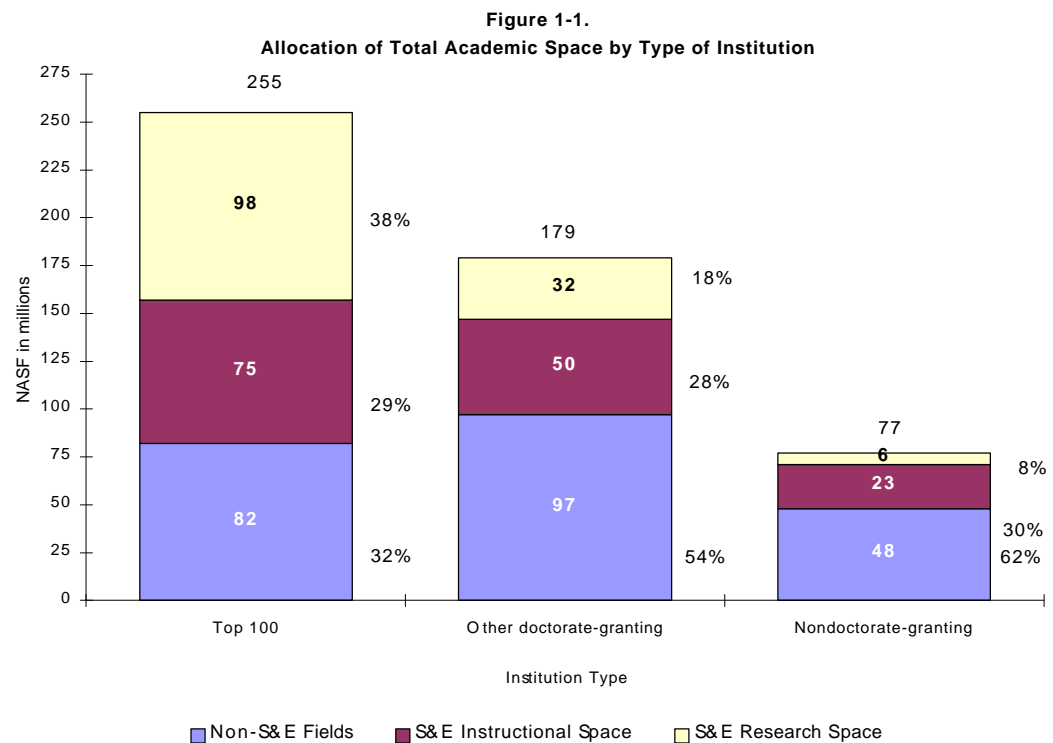
The ratio of S&E space to total academic space varied by type of institution. The top 100 universities devoted 68 percent of all academic space to S&E. Conversely, nondoctorate-granting institutions used the least amount (37 percent) of their academic space for S&E purposes (Table 1-2 and Figure 1-1).

Table 1-1. Amount of science and engineering (S&E) research space by institution type: 1996

<i>Institution type</i>	<i>Number of institutions</i>	<i>Space in all academic fields¹</i>	<i>Space in S&E fields</i>	<i>Research space in S&E fields</i>
Total	560	Net assignable square feet in millions		
		511	285	136
Doctorate-granting:				
Top 100 in research expenditures	100	255	173	98
Other	218	179	82	32
Nondoctorate-granting	242	77	29	6

¹ Projected from responses of 88 percent of participating institutions.

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.



SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

How Much S&E Space Was Used for Research?

In 1996, the total space devoted to S&E fields, including both instruction and research, comprised 56 percent of the total academic space at the nation's research-performing institutions (Table 1-2).

Almost half, 48 percent (136 million NASF), of all space in the S&E fields was devoted to S&E research. In the top 100 universities, S&E research space occupied 57 percent of all space in the S&E fields, while in the nondoctorate-granting institutions, research space occupied only 21 percent of the total S&E space.

The distribution of S&E research space in research-performing colleges and universities is roughly proportional to the distribution of research and development (R&D) expenditures. In 1994, the most recent year for which data are available, the top 100 universities accounted for 80 percent of all R&D expenditures, with the same institutions accounting for 72 percent (98 NASF divided by 136 NASF) of the total S&E research space in 1996 (Table 1-1).¹

Table 1-2. Science and engineering (S&E) research space utilization: 1996

Institution type	S&E space	Research space	
	As a percentage of total academic space	As a percentage of total S&E space	As a percentage of total academic space
Total	56%	48%	27%
Doctorate-granting:			
Top 100 in research expenditures	68	57	39
Other	46	39	18
Nondoctorate-granting	37	21	7

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

Has the Amount of S&E Research Space Increased?

Over the last eight years, the amount of S&E research space has increased steadily, from 112 million NASF in 1988 to 136 million NASF in 1996 (Table 1-3). This change reflects an increase of approximately 21 percent.

¹ The R&D data are taken from the National Science Foundation, *Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1994*.

Most increases resulted from steady growth at the top 100 institutions, wherein S&E research space grew 21 percent--from 81 million NASF in 1988, to 98 million in 1996. Research space at other institutions increased as well, although rate of growth was lower. At other doctorate-granting institutions, research space increased 18 percent, from 27 million NASF in 1988, to 32 million in 1996. After remaining steady at 5 million NASF since 1988, nondoctorate-granting institutions increased their research space to 6 million in 1996.

Table 1-3. Trends in the amount of science and engineering (S&E) research space by institution type: 1988-1996
[Net assignable square feet in millions]

<i>Institution type</i>	<i>1988</i>	<i>1990</i>	<i>1992</i>	<i>1994</i>	<i>1996</i>
Total	112	116	122	127	136
Doctorate-granting	107	111	117	122	131
Top 100 in research expenditures	81	82	88	91	98
Other	27	30	30	31	32
Nondoctorate-granting	5	5	5	5	6

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

How Much S&E Space Was Leased?

In 1996, research-performing colleges and universities leased 5.5 million NASF, or 4 percent of their total S&E research space (Table 1-4). This 5.5 million represents the largest amount of leased S&E research space since NSF began collecting data on S&E research facilities. The top 100 institutions leased the highest percentage of their space: 4.6 percent (4.5 million NASF). Nondoctorate-granting institutions leased less than 1 percent of their total S&E research space (16,600 NASF).

The amount of S&E research space that research-performing institutions lease has fluctuated somewhat since 1988, with the amount of leased S&E research space increasing from 4.4 million NASF to 5.5 million between 1994 and 1996. Most of this increase results from additional leased space among the top 100 universities.

**Table 1-4. Trends in the amount of leased science and engineering (S&E) research space
by institution type: 1988-1996**
[Net assignable square feet in millions]

<i>Institution type</i>	<i>1988</i>	<i>1990</i>	<i>1992</i>	<i>1994</i>	<i>1996</i>
Total	3.8	3.6	4.8	4.4	5.5
Doctorate-granting	3.7	3.5	4.7	4.3	5.4
Top 100 in research expenditures	2.8	2.6	3.5	3.7	4.5
Other	0.9	0.9	1.2	0.6	0.9
Nondoctorate-granting	0.1	0.1	0.1	0.1	0.1

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

How Was Research Space Distributed Across S&E Fields?

In 1996, nearly all institutions had research space in the biological sciences outside of medical schools (90 percent) and in the physical sciences (88 percent) (Table 1-5). Psychology and the social sciences followed (77 percent of all research-performing institutions had research space in psychology and 68 percent had research space in the social sciences).

Research space in five more fields was reported in over half of all research-performing institutions: mathematics, 61 percent; the computer sciences, 61 percent; the earth, atmospheric, and ocean sciences, 55 percent; and engineering, 51 percent. In contrast, only 20 percent of all research-performing institutions had S&E research space in the agricultural sciences. However, the total amount of research space in the agricultural sciences (22 million NASF) was greater than that in the biological sciences outside of medical schools (19 million NASF) or the physical sciences (18 million NASF). Several of the fields grouped as “agricultural sciences”—animal sciences, plant sciences, soil sciences, forestry, and wildlife management, to name a few—require large amounts of research space.

Over a fifth (21 percent) of all research-performing institutions reported S&E research space in medical schools, both in the biological and medical sciences. At the top 100 institutions, 64 percent reported research space in the medical sciences in medical schools, and 58 percent reported research space in the biological sciences in medical schools.

Table 1-5. Percentage of institutions with science and engineering (S&E) research space by institution type and field: 1996

Field	Total	Institution type		
		<i>Doctorate-granting</i>		<i>Nondoctorate-granting</i>
		<i>Top 100 in research expenditures</i>	<i>Other</i>	
Biological sciences-- outside medical school	90%	94%	85%	92%
Physical sciences	88	90	83	90
Psychology	77	86	78	71
Social sciences	68	89	63	63
Mathematics	61	83	64	50
Computer sciences	61	77	61	54
Earth, atmospheric, and ocean sciences	55	85	57	40
Engineering	51	86	56	33
Agricultural sciences	20	42	11	19
Medical sciences-- outside medical school	42	77	46	26
Medical sciences-- medical school	21	64	25	0
Biological sciences-- medical school	21	58	27	0

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

Between 1994 and 1996, no single S&E field experienced a large increase in the amount of research space (Table 1-6). Research space for the agricultural sciences increased from 20 million NASF in 1994, to 22 million in 1996. Biological research space outside of medical schools also increased by 2 million NASF during that same period (from 17 to 19 million NASF). Engineering research space, which demonstrated the most growth between 1988 and 1994 (from 16 million NASF to 21 million), continued to grow in 1996, to 22 million NASF. Medical science research space, both within medical schools and outside, grew by 1 million NASF, each.

Table 1-6. Trends in the amount of science and engineering (S&E) research space by field: 1988-1996

<i>Field</i>	<i>Net assignable square feet (in millions)</i>				
	<i>1988</i>	<i>1990</i>	<i>1992</i>	<i>1994</i>	<i>1996</i>
Total	112	116	122	127	136
Biological sciences-- outside medical school	16	18	17	17	19
Physical sciences	16	16	16	17	18
Psychology	3	3	3	3	3
Social sciences	3	3	3	3	4
Mathematics	1	1	1	1	1
Computer sciences	1	1	2	2	2
Earth, atmospheric, and ocean sciences	6	6	7	7	7
Engineering	16	17	18	21	22
Agricultural sciences	18	21	20	20	22
Medical sciences-- outside medical school	5	5	6	6	7
Medical sciences-- medical school	14	15	16	17	18
Biological sciences-- medical school	8	9	11	11	11
Other	4	2	2	2	2

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

The distribution of research space across the S&E fields approximated the distribution of R&D expenditures across the same fields. Engineering, for one, accounted for 16 percent of the S&E research space in 1996, as well as for 15 percent of 1994 R&D expenditures.² Mathematics and the computer sciences occupied 3 percent of the S&E research space and accounted for 4 percent of the R&D expenditures (Table 1-7).

² The 1996 expenditure data were not available at the time this report was written. The most recent expenditure data, 1994, were therefore used.

Table 1-7: Comparison of the distribution of 1994 research and development (R&D) expenditures and 1996 science and engineering (S&E) research space by field

Field	1994 R&D Expenditures ¹		1996 S&E Research Space	
	<i>Dollars (in millions)</i>	<i>Distribution (%)</i>	<i>NASF (in millions)</i>	<i>Distribution (%)</i>
Total	\$7,639	100%	136	100%
Engineering	1,147	15	22	16
Physical sciences	921	12	18	13
Environmental sciences	694	9	7	5
Mathematics/computer sciences	296	4	3	3
Life Sciences	4,043	53	77	56
Psychology	163	2	3	2
Social sciences	253	3	4	3
Other	112	1	2	1

NOTE: Percentages may not total to 100 due to rounding.

¹ NSF Survey of Scientific & Engineering Expenditures at Universities & Colleges, FY 1994.

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.